



FOREST ANALYSIS BRANCH

**Interim Standards for Data Package
Preparation and
Timber Supply Analysis**

Defined Forest Area Management Initiative

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1. Introduction

This document defines the standards for data packages and timber supply analyses submitted under the Defined Forest Area Management (DFAM) initiative for timber supply areas (TSAs).

Under the DFAM initiative, responsibilities for performing timber supply analysis and other activities related to the Timber Supply Review (TSR) in TSAs will be transferred to groups of licensees (DFAM groups). Legislation to support DFAM is expected to be introduced in the Spring of 2003, but will not be fully enforced with supporting regulations immediately. Until then, a transition period will be in place that provides licensees from specific TSAs the option of undertaking timber supply analysis for specific timber supply areas identified by the chief forester.

During the transition period, funding will be provided through the Forest Investment Account (FIA) Land-Base Investment Program. The transition period offers an opportunity for all involved in the TSR process to evaluate the standards and to provide feedback so that appropriate revisions can be made for subsequent years.

More information on the FIA Land-Base Investment Program is available at:

<http://www.for.gov.bc.ca/hcp/fia/>

These standards are intended to ensure the continued delivery of high-quality timber supply analyses to support provincial allowable annual cut (AAC) determinations. In most cases, the analysis standards simply formalize the current business process used in the review of Tree Farm Licence (TFL) timber supply analyses. For example, analysis data and analysis reports for TFLs are regularly submitted in digital format, but this is not currently specified as a requirement in the TFL data package guide or the licence document. In the DFAM standards, a number of new information-exchange formats for digital submissions are included, and will be tested during the transition period.

The TSR process for each management unit will be initiated by the chief forester through a letter requesting that eligible licensees undertake analysis activities associated with a specific TSA. After the TSR process for a particular management unit is initiated, Forest Analysis Branch will organize a meeting of representatives including: the DFAM group; Ministry of Forests (MoF) District, Region, and Forest Analysis Branch; and when possible, the Ministry of Sustainable Resources Management (MSRM) and the Ministry of Water, Lands, and Air Protection (MWLAP) to develop details of the process. One objective of this meeting will be to develop a Memorandum of Understanding (MOU) between the DFAM group and the MoF. The MOU will identify and clarify timelines, products, contacts and other information important to the process.

It should be noted that establishment and regulation of harvest levels through area-based allowable annual cuts offers an alternative approach to more traditional volume-based analytical approaches. Procedures and information requirements may vary depending on

approach used and the specific management unit. DFAM groups are encouraged to discuss options with their MoF contact at an early stage of the TSR process.

2. Principles

The following principles apply to the timber supply analysis and to the information used in the analysis:

- The purpose of the TSR and associated analyses is to support the chief forester's AAC determinations under Section 8 of the *Forest Act*. The analyses and supporting data must meet the requirements of the *Act*, and be consistent with the chief forester's requirements for an AAC determination;
- Sound and up-to-date information on land base, growth and yield and forest management considerations relevant to timber supply for the management unit and AACs should be used;
- Up-to-date analysis and modelling techniques appropriate for the management issues in the management unit should be employed;
- Information must be consistent with the chief forester's guiding principles for AAC determinations, as described in published AAC rationales. In the context of timber supply analysis, these principles imply the following:
 - The analysis should be based on current and, where applicable, legally-established forest management and land use objectives, plans and practices, or reasonable extrapolations of such objectives, plans and practices;
 - The possible effects of speculated or proposed changes in land use and management may be examined through sensitivity analysis but will not be viewed as current management;
 - The analysis must examine the potential impacts of any important uncertainties in the information.
- Given that uncertainties will always exist because of limits in knowledge, data and the ability to predict the future, the information used to represent current practice and knowledge in the timber supply analysis should reflect neither an 'optimistic' nor a 'conservative' interpretation of the information, unless either approach can be justified. Sensitivity analysis can be used to examine the range of possible outcomes and associated risks to timber supply given uncertainties.
- The public and first nations are provided an opportunity to review and comment on the data assumptions and analysis results;
- A co-operative and collaborative approach by industry and government representatives throughout the process will ensure all important management issues are considered. This will also avoid the need for the chief forester to request changes to submitted documents, or to require additional information after the analysis has been submitted by the DFAM group.

In reviewing information, the MoF will rely on accountability of the professionals who prepared data and performed the analysis (with requirements for documentation of data sources, analysis methods and assumptions). However, the ultimate accountability lies

with the chief forester, who determines the AAC. MoF staff, with assistance from staff in other government agencies will review the data package to ensure it meets the chief forester's needs for the AAC determination.

3. Data Package and Data Preparation

As the first milestone in the TSR process, a data package must be submitted to the MoF for review and acceptance. The MoF contact for submission of the data package will be identified in the MOU signed by the DFAM group and the MoF.

The DFAM group will post a digital version of the data package on an internet website or file transfer protocol (FTP) site, and provide that location to the MoF contact person. The contact person will ensure that the link is referenced on the MoF website. The objective of having a link to the data package from a central TSB site is to facilitate public access, while ensuring that it is clear that the DFAM group, not the MoF, is responsible for preparing the data package. Specific details of public and first nations consultation requirements are provided in Appendix 1.

The data package document should be provided in Adobe Portable Document Format (PDF). The PDF document security properties should be set so that text and graphic selection are enabled, and changes are not permitted. So that the PDF file is accessible to people with slower internet connections, individual files should not exceed 1 MB in size. Where a report exceeds this size limit it should be subdivided into sequentially numbered files.

3.1 Objectives of the data package

The purpose of the data package is to provide a clear description of information sources, assumptions, issues, and any relevant data processing or adjustments related to the land base, growth and yield, and management objectives and practices.

The following principles apply to the data and data package:

- The data package must describe, and where appropriate summarize, all data and information to be used in the timber supply analysis;
- The data package must contain descriptions of how current forest management, or reasonable extrapolations of current management will be modelled. The chief forester bases AAC determinations on current forest management, or reasonable extrapolations of current management. Current management consists of practices that are employed to achieve results and objectives in operational plans and, where applicable, to meet legally established forest management and land use objectives, plans and practices;
- The most current and best available data must be used;
- More detailed discussion should be provided in the package for data for which there is a high degree of uncertainty;
- The data package must contain a summary of plans for examining the potential impacts of important uncertainties in information (i.e., planned sensitivity analysis).

- The evidentiary basis for information used in analyses must be available on request, and to the extent possible be included in the data package. Evidence could include the following:
 - a description of data sources;
 - the source data itself;
 - a description of sampling and data analysis methods or standards;
 - digital or analog maps of the land base (e.g., forest cover, ownership, habitat areas);
 - results of any reviews or audits of source information or inventories;
 - any acceptances by appropriate professionals (e.g., terrain stability mapping).
- When collecting or analyzing data to include in the data package, existing standards should be followed, unless justification is provided for diverging from standards. Such justification should demonstrate that although standards were not followed, the information is the best available that could be obtained for the timber supply review.
- Where possible, the implications to the timber supply analysis (e.g., increased uncertainty) of diverging from the standards should be examined and reported. The custodians of the standards and data should be asked to review: (1) the proposed differences from the standards in advance of the data collection and analysis; and (2) resultant information to be used in the timber supply analysis. Comments regarding the implications of the modified standard including sensitivity analyses, where appropriate, should be submitted to the chief forester for consideration during the AAC determination.
- The choice of a particular timber supply model is left to the discretion of the DFAM group. However, any new or significantly revised model with which the chief forester and TSB staff are unfamiliar will require the submission of additional documentation and/or explanation to facilitate review by TSB staff study prior to its use for the support of an AAC determination. This documentation should include the model name, version, and applied functionality (e.g., optimization, simulation, adjacency, constraint/objective handling).

The *Supplemental Guide for Preparing Timber Supply Analysis Data Packages* provides an example format for the data package. The guide is posted at:

http://www.for.gov.bc.ca/hcp/fia/landbase/tsa_ifpa.htm

The guide itself is not a standard that must be followed, but rather illustrates one way to meet the requirement for a data package that contains relevant information on land base, growth and yield and management issues. A complete data set does not need to be submitted with the data package. However, submission of a final data set is required as part of the analysis report (see Section 7.2.3, "Georeferenced data set" for a description of the applicable standards).

4. Draft Base Case Harvest Forecast

Development of the base case harvest forecast is a key milestone in the timber supply analysis process. Each DFAM group is required to submit a draft base case harvest forecast with supporting diagnostic summaries. For example, in the case of volume-based analyses, information may include the following:

- Total and merchantable growing stock during the analysis horizon;
- Area harvested per year in the modelling;
- Average age of stands at harvest, weighted by both volume and area harvested;
- Average volume per hectare of stands at harvest;
- The relative contributions of existing natural stands and managed stands to the harvest forecast;
- Age class composition of the forest over time;
- Alternative harvest forecasts that help to explain timber supply dynamics and the reasoning for the choice of the draft base case.

The draft base case harvest forecast and supporting information should be submitted both electronically (MS Word, RTF, PDF, Excel) and in hard copy for review by the MoF timber supply forester. The purpose of this requirement is to help confirm the suitability of the base case before further investigations (e.g., sensitivity analyses) are undertaken as part of the timber supply analysis.

Acceptance of the draft base case does not imply that the chief forester will determine the AAC at the same level as the harvest level depicted in the base case. The AAC determination reflects considerations required by the *Forest Act*. For example, additional information not incorporated in the timber supply analysis may indicate a harvest level different from that projected in the base case. Also, DFAM groups should be aware that MoF acceptance of the draft base case is not an endorsement that the harvest forecast accurately reflects the underlying data. This will normally be addressed during a detailed review of the analysis report.

5. Analysis Report

The analysis report to be provided to the MoF comprises two parts: a *Written Report*, and an *Electronic Report*. The components and manner of submission of these two "reports" are described in the following sections.

The general principles associated with timber supply analysis and reporting are outlined in Section 5. A description of the components of the analysis report is described in Sections 6 and 7. Standards and expectations related to specific timber supply modelling issues, such as model choice, analysis horizon length, harvest flow and natural disturbance modelling are discussed in Section 8.

5.1 Objectives and principles of the timber supply analysis

The timber supply analysis provided by a DFAM group must provide the chief forester with the information needed to determine the AAC for the TSA under Section 8 of the *Forest Act*.

These standards describe requirements for preparing the timber supply analysis, and specify the minimum modelling, summary level reporting and data transmission requirements.

The standards do not specify detailed analysis methods or act as a template for a comprehensive reporting format. Rather, they focus on the general information requirements of the chief forester. Specific aspects of performing and presenting the analysis will largely be left to the discretion of the DFAM group, keeping in mind the principles that apply to the data and analysis (see Sections 2, 3 and the following paragraph).

The purpose of analyzing forest management assumptions and the associated timber supply implications is to provide insight into their dynamics and interactions. Developing such understanding requires the following:

- the issues relevant to the analysis associated with land base, growth and yield and management objectives be described in detail;
- the main variables affecting the analysis results be clearly defined and discussed;
- the results of the analysis be described and discussed in detail giving reasons for the outcomes;
- the uncertainties associated with these variables, and the effects of the uncertainty on the outcome of the analysis be thoroughly examined.

6. Written Report

6.1 Written report content

The *Written Report* must contain the following elements:

- The final data package report, including the final version of all data and assumptions used in the analysis. The final data package must be consistent with the data package standards described earlier in this document;
- Documentation of the results of the timber supply analysis, including interpretation of the analysis results;
- An executive summary that will serve to provide interested parties, including the public and First nations, with an overview of the analysis findings;
- Socio-economic information should be included in the timber supply analysis report. Guidelines for socio-economic assessments are being developed by MoF Economics and Trade Branch, and will be posted on the FIA website at:
http://www.for.gov.bc.ca/hcp/fia/landbase/tsa_ifpa.htm

- If desired by the DFAM group, a recommended course of action (e.g. proposed harvest level, requirements for additional study, etc.) supported by the results and interpretation of the analysis.

In contrast to the data package, which is submitted to the MoF for review at the same time as it is made available for public and First Nation review, the analysis report will be reviewed and accepted by the MoF prior to being made available publicly. The submission formats are discussed under Section 6.3, "Written Report Submission and Format", below. Specific details of public and first nations consultation requirements are provided in Appendix 1.

The following sections (6.1.1. through 6.1.5) discuss specific components of the *Written Report*.

6.1.1 Final data and assumptions

The final completed data package is to be appended to the report. Any changes made to the data package since the initial submission should be highlighted for easy identification.

6.1.2 Land base and forest management context

A table describing the categories of land within the timber harvesting land base must be included in the analysis report. The table helps to explain the derivation of the timber harvesting land base and provides an important input to provincial-level summary reporting. Table A-1. in Appendix 1 provides an example format. The table should also include the area of land deducted from the total TSA and Crown managed productive forest area.

This same table must be provided in digital format as part of the *Electronic Report* described in Section 7. Key values in the table include: gross area, area under Crown management, forest area under Crown management, forest managed for timber supply, current timber harvesting land base, future timber harvesting land base. As illustrated in Table A-1., this table should list all items excluded either partially or fully from the timber harvesting land base.

To help illustrate key attributes of the management unit, the timber harvesting land base productive forested area should also be described in terms of leading species, site quality, stand age, area subject to management objectives, and other features relevant in the area (e.g., operability classes). The information can be presented using a combination of text, table or graphic format as appropriate.

6.1.3 Results

The results will consist primarily of harvest forecasts, non-timber objective / constraint assessments and harvest statistics presented using text, summary tables and graphs describing the results of both the base case (current management) and sensitivity analyses. The analysis report and related appendixes should include sufficient information to impart an understanding of the main factors determining timber supply. If applicable, the report should describe how any proposed practices (that is, those beyond

current management) have affected timber supply dynamics and resulted in changes to projected harvest levels.

For the most part, requirements for specific sensitivity analyses to be performed are not provided in the standards. The specific sensitivity analyses should be chosen so as to address the key issues and uncertainties for the given management unit. Section 8.4, "Uncertainty", below, as well as the *Supplemental Guide for Preparing Timber Supply Analysis Data Packages, Defined Forest Area Management Initiative* contain more discussion on sensitivity analysis.

The only requirement in these standards for the provision of specific harvest forecasts additional to the base case is for alternative harvest flows based on the same inputs as the base case. Alternative harvest flows can provide important information on the selection of the base case flow and on timber supply dynamics in the base case.

6.1.4 Interpretation

The interpretation component of the report is intended to provide more insight into the analysis results and the implications to timber supply. The interpretation should adequately explain the outcomes of the analyses including why particular timber supply forecasts have resulted from the set of specific assumptions and discuss the sensitivity of the timber supply to changing assumptions.

These explanations should make reference to the information provided on timber inventory levels (growing stock), areas and average volumes harvested, average age of harvested stands, and age class distributions over time. In addition, discussion about the base case should include information on relevant forest management objectives (e.g., areas in seral stages by landscape unit, or area achieving visually effective green-up in visually sensitive areas). Interpretation should also describe and discuss harvest flow — including the initial harvest rate; reasons for declines/rises in the schedule; relationship between short- to -medium term timber supply and the long-term harvest level — and the criteria used in the analysis.

6.1.5 Recommendation

The DFAM group may provide a recommended course of action stemming from the analysis findings, such as a harvest forecast or study to fill critical information gaps. The results and interpretation of the analysis should support discussion of any recommendation. In the case of recommended harvest forecasts, the discussion should address the consequences of any issues (e.g., information gaps, availability of technology, funding, etc.) that could affect the ability to achieve forecasted levels.

6.2 Written report audience

Recognizing that timber supply analysis is technical in nature and that a cross-section of the public will want to review and understand the analysis, attempts should be made to write the report for the non-technical reader.

The executive summary should be written in a manner that is understandable to a relatively broad non-technical audience public, since it will be a focus of public review.

As such, the technical level of the summary would in most cases be simpler than the main body of the report.

6.3 Written report submission and format

The analysis report title page will indicate the following:

- the name of the management unit;
- the date of completion;
- the name and signature of the person responsible for the preparation of the report;
- contact information for those who wish to provide feedback to the DFAM group regarding the content of the report.

For review by the MoF, the DFAM group will provide an electronic copy of the analysis report in MS Word or Rich Text Format (RTF).

Once the analysis has been accepted by the chief forester or designate, the DFAM group will ensure that the MoF reviewing analyst has the final version in MS Word or Rich Text Format (RTF), and Adobe Portable Document Format (PDF). A hard copy version of the final accepted report with the original signed title page will be sent to TSB for archiving.

To facilitate public access and review, the DFAM group will also post the analysis report on a publicly-accessible internet website or file transfer protocol (FTP) site, and provide that location to the TSB contact person so that the link can then be referenced on the provincial TSR website.

An explanation should be available to members of the public regarding how the DFAM analysis report fits into the AAC determination process. In order to provide such context to, for example, members of the public who access the document directly from an internet search engine, the first page should include the following text:

"This document was prepared to support an allowable annual cut determination by British Columbia's chief forester. To learn more about this process please visit the following website:

<http://www.for.gov.bc.ca/tsb/>

or contact:

*Forest Analysis Branch
Ministry of Forests
P.O. Box 9512, Stn. Prov. Govt.
Victoria, B.C., V8W 9C2
Telephone: (250) 356-5947"*

The web-accessible analysis report documents should be in Adobe Portable Document Format (PDF). The PDF document security properties should be set so that text and graphic selection are enabled, and changes are not permitted. So that the PDF version is accessible to people with slower internet connections, individual files should not exceed 1 MB in size. Where a report exceeds this limit it should be subdivided into sequentially numbered files.

7. Electronic Report

7.1 Electronic report objective

The objective of the *Electronic Report* specification is to realize efficiencies with regard to transmission, review and sharing of analysis information. This specification will provide the following:

- Reduce the amount of time required to review analyses and prepare information for AAC determinations;
- Reduce the number of special requests made to licensees for additional information required as part of the analysis review;
- Reduce the likelihood of errors associated with transcribing / translating information from graphs, non-standard formats and reports;
- Greatly reduce the time and effort necessary to gather and organize analysis information for strategic analysis projects and provincial reporting requirements.

7.2 Electronic report content

The *Electronic Report* consists of three parts, as follows:

- summary analysis elements;
- all model configuration, input, and output files; and,
- the georeferenced data set used to conduct the modelling.

7.2.1 Summary analysis elements

A core set of information is required to prepare for AAC determinations and support provincial reporting capabilities. From the large volume of information prepared in the course of an analysis, five core analysis elements that apply to the entire management unit have been selected for electronic information exchange, as follows:

1. timber harvesting land base area determination table;
2. forecast of Crown productive forest area by BEC variant and age group that results from the base case timber supply forecast;
3. all final harvest volume forecasts (i.e., base case as well as sensitivity analyses);
4. projections of the following base case forecast statistics:
 - area harvested per year by period;
 - average age harvested by period;
 - average yield at harvest (cubic metres per hectare);
 - growing stock, and non-recoverable losses;

5. proportional contribution to forecast harvests from existing natural and managed stands, and of any other relevant silvicultural groups (e.g., partial harvesting areas).

7.2.2 Model configuration, input, and output files

The aggregate information imparted by analysis reports often does not provide the level of detail required for review of analysis results and strategic level analysis. Frequently, statistics are required for a sub-unit (e.g., a landscape unit) or during a particular period of time (e.g., 2010); analysis reports typically deal with aggregations of the analysis inputs and outputs. To provide information at a sufficiently detailed level, the standards for the Electronic Report require provision of all model input and output files. This will allow the MoF contact person to create statistics and outcomes for sub-populations. This information then will provide a means to confirm the analysis methodology and to access more detailed statistics for reporting.

To avoid any significant costs, these files may be submitted in a file format native to the modelling platform that is used to conduct the analysis. A description of the format of the data must also be provided to allow MoF staff to read and interpret the files. If changes to model input and output file formats occur relative to those known to MoF staff, those changes should be made known at the time of delivery of the input and output files.

7.2.3 Georeferenced data set

The georeferenced data set reflecting the available timber harvesting land base is one of the many valuable pieces of information generated in the course of conducting a timber supply analysis. Receipt of this file by the MoF will permit supplementary analysis, review of submission information and detailed reporting and mapping. In addition, it will be critical in the compilation of a provincial data set, which will be used to respond to the strategic questions increasingly posed by those within and outside the forest sector at provincial, national and international scales.

The georeferenced data set will include:

- a digital map submitted in a format that can be translated to Arc/Info format;
- the associated attribute information used in the analysis; and
- a data dictionary including the format and contents of each variable (naming conventions, and coding of the file).

The data set must contain all of the information used to create the modelling files for the timber supply analysis, such as inventory attributes, the zonation of management objectives, and including model constructs such as analysis units.

7.3 Electronic report transmission and format

The *Electronic Report* will be delivered in a combination of ASCII text file format, and — in the case of the georeferenced data set and model input and output files — in a format native to the modelling platform used (with the previously noted condition that the georeferenced data set must be translatable into ArcInfo format). While the delivery of most files will be possible via FTP, there will be some necessity for delivering larger data

sets (e.g., greater than 500 MB) via CD-R or DVD-R media. Formatting for the summary analysis elements is described in Appendix 1 of this document under Electronic Report Specifications.

8. Modelling

8.1 Model use

As outlined in the data package section, no timber supply model is specified by the standard; choice of model is left to the discretion of the DFAM group. See Section 3.1, "Objective and principles for the data and data package" for additional information on model choice.

8.2 Modelling horizon and interval

To acknowledge the time frame of timber growth and yield dynamics, and to demonstrate the long-term outcomes of forest management and harvesting, the modelling horizon for all forecasts is specified as a minimum of 250 years. This horizon length is selected on the basis of demonstrating sustainability of outcomes over the entire land base over two full rotations, and reflects the minimum used in previous TSA analyses.

The time-period length or temporal resolution assumed in the model (e.g., annual, 5 years, 10 years) is at the discretion of the DFAM group. However, the period length must be sufficiently short to accurately represent any issues or objectives (e.g., green-up constraints) present in the first few decades. For example, it is unlikely that a 20-year or 50-year time period length will adequately represent the interactions among forest inventory dynamics and conditions, and management objects and practices over the next several years — the period of time over which the AAC applies.

8.3 Harvest flow and base case formulation

Timber supply forecasts employing assumptions about current and proposed practices must follow reasonable flow patterns over time. In general, a reasonable flow pattern provides for a controlled and gradual transition from short-term to medium- and long-term harvest levels, and avoids large and abrupt disruptions in supply. Considerations include the following:

- the acceptable rate of harvest level decline (if any is necessary);
- the degree to which medium-term timber supply may appropriately drop below the long-term harvest level;
- the timing of increase to the long-term harvest level if it is higher than medium-term levels.

With respect to the short term (typically considered as the first 20 years of the forecast) harvest level, the most common reference point is the current AAC with appropriate deletions or additions (e.g., woodlot licences and community forest agreements). This adjusted AAC is the most frequent starting level for a base case. The common practice in defining the base case forecast has been to determine the maximum length of time that

the current AAC can be maintained while allowing for a stable harvest forecast with controlled changes and a sustainable long-term level.

In general, rates of decline should not exceed about 10 per cent per decade. Steep declines in the timber supply projection in the medium term should be avoided because they may indicate that short-term supply is being maximized at the expense of timber supply further in the future. If declines in timber supply from the current AAC are forecast, the timber supply implications of different decline rates should be shown in alternative forecasts.

With respect to medium-term troughs, a difference between medium-term and long-term harvest levels may be justified in some cases. Troughs can be rationalized in some cases because medium-term supply depends more on the existing stock of timber and the timing of availability of regenerated stands, while long-term timber supply is typically a function of forest growth which is affected by site productivity and forest management practices.

If the inventory of existing timber is limited, maintaining medium-term levels above or equal to the long-term level may not be possible without causing timber supply disruptions in the long term. Likewise, a decline from a higher short-term harvest level to a lower level in the medium term may be appropriate if it can be shown that the associated harvests do not jeopardize or cause disruptions to long-term productivity. In general, the maximum difference between the level of a medium-term trough and the long-term level should not exceed the gain in long-term productivity attributable to silvicultural management regimes assumed in the base case. This difference normally ranges from 20 to 30 per cent; however, the specific difference is management unit dependent.

The timber supply forecasts for the base case and all sensitivity analyses should display the full potential timber supply given the information on land base, growth and yield and management objectives. The forecasts must follow all considerations discussed above regarding stability and sustainability. In most cases, a harvest level forecast that is below the maximum achievable is indicated if the total growing stock increases over the long term. Forecasts that are below the maximum level can make it difficult to understand the true impacts of changes in and uncertainties about inputs.

The analysis should include different harvest flows that examine each of the considerations discussed above. To summarize, these considerations are as follows:

- manage the transition from short-term to medium- and long-term harvests, and avoiding large and abrupt disruptions in supply;
- minimize the degree to which medium-term timber supply drops below the long-term sustainable harvest level and ensure that any trough is justified given existing forest conditions; and
- increase the forecast to the long-term harvest level, if it is higher than medium-term levels, at a time coinciding with the transition of projecting harvesting from existing natural to managed stands.

One of the harvest flows illustrated in the analysis report should show the implications of maintaining the current AAC for as long as possible while achieving a reasonable timber supply projection for the medium- and long-terms. In many cases, such a forecast will serve as the base case.

Where a decline in timber supply is anticipated, the general approach to modelling harvest flow is to not increase short-term levels above the current AAC unless there is a sound demonstrated forest management reason. This approach reflects the perspective that it is preferable not to increase AACs in the short term only to force reductions in the near future. Sound forest management reasons could include the high risk of loss of stands to fire, insects or disease due to current or developing forest or pest conditions.

Experience has demonstrated that timber flow policy is difficult to communicate effectively. For this reason, submission of a draft base case is being required as a milestone in the process (see Section 4, above). Additional information on harvest flow is available in a working paper entitled *Harvest flow considerations for the Timber Supply Review* available on-line at:

http://www.for.gov.bc.ca/hcp/fia/landbase/tsa_ifpa.htm

8.4 Uncertainty

Most of the assumptions used in timber supply analysis are characterized by uncertainty. Sensitivity analysis must be conducted to assess the potential impacts to timber supply of uncertainty in the assumptions used in the base case, and if applicable, the recommended harvest. These analyses should examine a reasonable range of uncertainty associated with management, land base and growth and yield assumptions. The analysis report should describe the sensitivity analysis results, and to the extent practicable, provide assessments of the likelihood that the assumption used in the base case is correct. If there is uncertainty around the assumption, some assessment of how the assumption has over- or under-estimated timber supply in the short, medium- and long-terms should be provided.

A list of specifically required sensitivity analyses is not provided since each management unit in the province differs with respect to issues and related uncertainties. However, the section entitled Timber Supply Forecast / Options / Sensitivity Analyses in the *Supplemental Guide for Preparing Timber Supply Analysis Data Packages* describes some suggested standard sensitivity analysis which may be valuable if new information is discovered in the course of the review. As discussed above under Section 6.1.3, the only specific requirement for sensitivity analysis is that alternatives to the base case harvest flow be provided.

8.5 Natural disturbance modelling

Because the forested state of the area excluded from harvesting determines its ability to contribute to non-timber objectives which must otherwise be met by harvestable areas, it is vital to recognize that natural stand disrupting events and agents like fire, insects, disease, landslides and blow down will have impacts on the entire productive forest.

In the analysis, some recognition of how disturbances may affect the contribution of areas outside the timber harvesting land base to forest management objectives is required. A variety of options are acceptable including disturbing the non-timber productive forest in the timber supply model at a rate which reflects the estimated natural disturbance return interval. The specific approach is left to the discretion of the DFAM group, given local conditions and available information.

Additional information is contained in the working paper *Modelling Options for Natural Disturbance of Areas outside the Timber Harvesting Land Base*, available on-line at: http://www.for.gov.bc.ca/hcp/fia/landbase/tsa_ifpa.htm

Appendix 1 — Electronic Report Specifications

1) Timber Harvesting Land base Determination Table

Variables from this table shown in bold type will be common in all management units, whereas the specific deductions may vary among units. Units of measurement will be hectares. This table can be submitted as a spreadsheet or as an IBM comma separated value (CSV) formatted ASCII file.

Table A-1. Sample timber harvesting land base determination table

Classification	Productive forest area (hectares)	Area (hectares)	Per cent of TSA area	Per cent of productive forest area
Total TSA (incl. Freshwater)		1 239 633	100.0	
Not administered by the province of B.C.		135 997		
Non-forest and non-productive forest land		486 279		
Non-commercial cover ^a		4 059		
Crown managed productive forest^b		613 299	49.5	100.0
Reductions to Crown managed productive forest				
Not managed for timber supply	107 075	107 075		
Low timber productivity	29 777	29 658		
Unmerchantable forest types	12 665	11 826		
Inoperable areas	192 445	165 452		
Uneconomic areas	7 633	1 813		
Sensitive terrain areas	39 722	17 142		
Riparian management areas	14 904	10 687		
Existing unclassified roads, trails and landings	8 833	8 833		
Total current reductions		355 449	28.7	58.0
Current timber harvesting land base		257 850	20.8	42.0
Future reductions				
Logging roads, trails and landings		7 280	0.6	1.2
Long-term timber harvesting land base		250 570	20.2	40.9

(a) While areas of non-commercial brush and trees are classified by the B.C. Forest Inventory as 'productive forest', they are excluded from the productive forest estimates in the analysis to be consistent with the definition given in the FPC *Landscape Unit Planning Guide*.

(b) Crown managed productive forest excludes woodlots, and community forests which are not administered as part of the TSA for AAC determination. It includes all forest area — for example, parks — expected to contribute to forest management objectives.

2) Forecast Crown Managed Productive Forest at Age Group and BEC Variant

The area (hectares) of Crown managed productive forest by BEC variant, subdivided into the five age classes will be provided for the management unit over the entire base case harvest forecast (a minimum of 250 years). This will fulfil basic provincial information requirements of the Ministry of Water, Lands and Air Protection,

The five age classes are: 0-40 years, 41-100 years, 101-140 years, 141-250 years and 251 years and greater. Format of the file will follow the example provided by Table A-2. Reporting should be provided at a minimum of 10-year intervals for the first two decades, and may be increased to every 20 years thereafter if desired. The table should be provided as a plain, comma delimited ASCII text file (CSV).

Table A-2. Example forecast Crown managed productive forest at age by variant

ESSFxv1	Year	0-40 years	41-100 years	101-140 years	141-250 years	251+ years
	2003	5000	1000	1500	12500	10000
	2013	5495	1499	1499	12490	8993
	2023	5491	1997	1997	11481	8985
	2033	5486	2993	1995	10474	8978
	...					
	2153	3917	5385	5875	8323	5875
ESSFxv2	Year	0-40 years	41-100 years	101-140 years	141-250 years	251+ years
	2003	1600	320	480	4000	3200
	2013	1759	480	480	3997	2878
	2023	1757	639	639	3674	2875
	2033	1756	958	638	3352	2873
	...					
	2153	1253	1723	1880	2663	1880

3) Harvest Forecasts

Submit all harvest forecasts referred to in the analysis report (base case, alternative forecasts, sensitivity analyses) in one electronic file, in IBM ASCII format. For these forecasts, include a unique name, the date they were created, and the final year represented. The reporting interval will follow the modelled interval and span a minimum of 250 years. Provide files in a format consistent with the example given in Figure A-1. Provide harvest forecast information in cubic metres harvested per year, non-recoverable losses, and the total forecast.

Figure A-1. Sample Harvest Forecast File

	"10% site index increase sensitivity"	← Unique, descriptive name in quotations
	22-Feb-2003	← Date the forecast was created (DD-MMM-YYYY)
forecast 1	2003, 353500, 1100, 354600	← Year, harvest, NRL, total comma separated values
	2008, 318150, 1100, 319250	
	2013, 286335, 1100, 287435	
	2023, 257702, 1100, 258802	
	2033, 231931, 1100, 233031	
	2043, 208738, 1100, 209838	
	2253, 208738, 1100, 209838	← Last year, harvest, NRL, total of forecast
	"alternative forecast A"	
forecast 2	23-Feb-2003	
	2003, 353500, 1100, 354600	
	2008, 353500, 1100, 354600	
	2013, 266335, 1100, 267435	
	2023, 237702, 1100, 238802	
	2033, 211931, 1100, 213031	
	2043, 208702, 1100, 209802	
	2253, 208702, 1100, 209802	

4) Base Case Harvest Forecast Statistics

For the base case harvest projection the following forecast statistics will be provided for each modelled period, or decade (whichever is shorter) over the minimum 250-year simulation horizon:

- Average annual area harvested (hectares per year);
- Average volume per hectare harvested (cubic metres per hectare);
- Minimum, maximum and area-weighted average age of harvested stands in period;
- Average annual non-recoverable loss estimate (volume and/or area);
- Volume harvested from old growth, existing second growth and regenerated stands.

The reporting interval will be at least every 10 years.

Table A-3. Example table of base case harvest forecast statistics

Start decade	Yield (m ³)	Area clear cut (ha)	Area partially cut (ha)	Minimum harvest age (years)	Average harvest age (years)	THLB growing stock (m ³)	Merchantable growing stock (m ³)	NRLs (m ³ or ha)	Yield from existing unmanaged stands (m ³)	Yield from managed stands (m ³)
2003	278	2596	0	62	124	49398968	40699652	30965	277	1
2013	270	2680	0	60	119	46983164	41604996	30965	268	2
2023	298	2420	0	76	151	43974988	39528068	30965	297	1
2033	287	2519	0	70	140	40790440	36562500	30965	285	2
2043	306	2359	0	74	147	37918340	32086774	30965	301	5
2053	287	2277	0	66	132	35616316	27863756	30965	271	16
2063	251	2537	0	55	110	34518808	25940064	30965	172	79
2073	246	2586	0	53	105	33855676	24594420	30965	116	130
2083	263	2419	0	51	101	33340382	23778660	30965	76	187
2093	287	2214	0	57	114	32979940	21769960	30965	107	180
2103	287	2217	0	56	112	33030102	20680792	30965	68	219
2113	280	2268	0	55	110	33377854	20189274	30965	48	232
2123	288	2206	0	56	112	33911800	19677676	30965	46	242
2133	267	2386	0	54	107	34575836	20401480	25088	18	249
2143	256	2483	0	50	99	35149012	20543518	25088	8	248
2153	248	2562	0	46	92	35641580	22318102	25088	7	241
2163	265	2395	0	49	97	35957800	23694552	25088	5	260
2173	280	2271	0	50	100	36085396	23863206	25088	3	277
2183	284	2240	0	51	101	36085332	24434092	25088	5	279
2193	286	2222	0	50	100	35954620	24226812	25088	2	284
2203	281	2261	0	52	104	35832708	23583170	25088	4	277
2213	262	2428	0	50	99	35939324	23877280	25088	1	261
2223	265	2399	0	51	102	35886016	23730225	25088	0	265
2233	283	2251	0	53	106	36244896	22858964	25088	0	283
2243	266	2389	0	46	92	36650784	23080978	25088	0	266
2253	273	2332	0	46	91	36779056	24099930	25088	0	273

